1.1 TEST EQUIPMENT FOR THE BBC AND ELECTRON MICROCOMPUTERS: Introduction

The following hardware/software packages are available to Service Centres for use before, during, and after repairs to the Electron and various models of the BBC microcomputer:-

BBC MICROCOMPUTER

1) Progressive Establishment Tester (P.E.T.)

   The Progressive Establishment Tester is a device which is attached to a partly functioning BBC Microcomputer and which performs a series of comprehensive tests on all aspects of the hardware, as well as ensuring that correct copies of firmware are all in place.

   Further information on the P.E.T. can be found on the appropriate Engineering Information Sheet in the following pages.

2) Final Inspection Tester (F.I.T.)

   The Final Inpection Tester is used in conjunction with a cassette of test programs to complete the soak testing of a repaired or upgraded machine.

3) BBC FIT Test Station

   The Test Station is a dedicated computer used to semi automatically test machines of all types, and it includes software and hardware for testing ECONET and Disc interfaces.

4) 6502 FT (Functional Test)
   This test equipment will be released in the near future and will be used to prove the functions of the 6502 second processor.

ELECTRON

1) Production Inspection Tester (P.I.T.)
   The Production Inspection Tester is a device which is used in conjunction with a BBC micro when attached to a partly functioning Electron, to produce diagnostic information by means of a series of comprehensive tests.

2) Watchdog

   The Watchdog is used to carry out soak testing of a repaired Electron. It provides information to indicate that the Electron has continued to operate for the period of the soak test.

1.2 BBC MICROCOMPUTER TEST EQUIPMENT: General Description

Progressive Establishment Tester (P.E.T.)

The requirement that all repaired or upgraded machines must be PET tested is now a recommendation only. It is still very strongly suggested that every dealer should have a PET, as they are also very useful as fault-finding equipment.

The main PCB is at Issue 1 and no changes are outstanding. The buffer PCB is at Issue 2, but all Issue 1 buffers were modified to Issue 2 standard when manufactured.

The PET EPROM code is at Issue 4.0. The only previous Issue was 3.0. The only difference between the two Issues is that 4.0 includes the CRC values for OS 1.2 (as well as 0.1 and 1.0, which were in Issue 3.0) and BASIC II (as well as BASIC I, which was in Issue 3.0). It was originally intended to add tests for the Disc and Econet areas, but as these are fully covered by the FIT tests this is not planned for the near future.

The PET manual is currently at Issue 1. It is not recommended that the instructions within the service manual are used as they are not complete.

All the above is sold under product code ABX03.

N.B. The PET is not fully compatible with the speech option on BBC machines. Unless the TMS5220 is removed (IC99) the PET will fail tests 1.4 to 1.7 and the "silence" and "sound" tests will be corrupted.

Final Inspection Tester (F.I.T.)

This now consists of the following equipment:

i) FIT PCB

The standard PCB as supplied for the last year. It is currently at Issue 1, but will soon be going to Issue 2 to correct a missing track which has been fitted as a link on all previous production units.

ii) FIT Cassette

Currently at Issue 3 (CTESTA3 and CTESTB3). Previous issues are 1 and 2. The changes are only minor and, although it is preferred that the latest version is used, the earlier issues are acceptable.

iii) FIT with Cassette Manual

Currently at Issue 2. Changes from Issue 1 are minor (mainly spelling mistakes!) plus details of the Issue 3 software. The Issue 1 manual covers Issue 2 software and the description in the BBC service manual is for Issue 1 software.

Items (i) to (iii) are currently sold as ABX02.

iv) BBC FIT Test Station

The idea of the test station is to enable full testing of the Econet Interface. It has, however, been extended to cover all Models as it includes the additional advantage of not needing a cassette, eliminating the necessity for re-winding tapes. It also provides extra testing of the cassette interface as both "Load" and "Save" operations are carried out (the FIT cassette only tests "Load"). For Models A and B it is an alternative to the FIT cassette, but is compulsory for Econet models (A+E, B+E, B+D+E).

The test station upgrade comes in three parts:

a) Model A+B Test Station Kit

This contains a slightly modified operating system EPROM (TOS1.2), two further EPROMS containing the test software, two cassette leads and Upgrade and Operating Instructions. It requires a Model B computer (for modification to a test station) plus necessary monitors and TVs. The FIT PCB requires two resistors (also supplied) to be added for the cassette-to-cassette link to operate fully at 1200 baud.

Using the test station the standard Model A and B FIT tests can be transferred to the unit under test via the cassette sockets on the FIT PCB.' The test procedure is then identical to the standard FIT cassette tests except for the transmission of the Pass/Fail messages from the unit under test to the test station prior to the sound test.

The software supplied includes tests for Econet and Disc models, but these are not usable without items (b) and (c).

b) FIT Econet Test Kit

This includes the "Econet Test Box" with all leads, plus an Instruction Manual and full details of how to upgrade all Issue PCBs to include Econet (not supplied in the Econet Upgrade Kit).

The test box provides the clock and terminators for a short Econet network (two computers), so that the Test Station and Unit under test can communicate via Econet. It also incorporates a "worst case" network simulator (switched in and out of the line by the Test Station) so that tests can be carried out on "Good" and "Bad" lines.

All the test software is supplied with the Model A+B test kit.

The test station must, of course, have an Econet Interface fitted.

c) FIT Disc Test Kit

A set of 3 discettes (80 track, double sided). Discettes "SCRATCH 0" and "SCRATCH 1" are simply formatted discs with specific titles. Discette "TEST 0" contains 3 programs.

Two of the programs are used within the Test Station routine. The third is an extract of one of the first two which enables the Disc Interface to be tested in isolation from the Test Station.

Full operating instructions are supplied, and a pair of 80 Track BBC drives will be required.

In summary, the following FIT equipment is required for various Models of BBC computer as listed:

Model A

Either FIT Cassette
or Model B + "A+B" test station kit + monitor + FIT PCB
plus B&W monitor) for unit under test
Colour TV)

Model B

Either FIT Cassette
or Model B + "A+B" test station kit + monitor
plus FIT PCB
B&W monitor)
RGB monitor) for unit under test
Colour TV)

Model A + Econet

Model B + Econet)
"A+B" Test Station Kit)
Econet Test Kit) for test station
FIT PCB)
Monitor)
B&W Monitor) for unit under test
Colour TV)

Model B + Econet

Model B + Econet)
"A+B" Test Station Kit)
Econet Test Kit) for test station
FIT PCB)
Monitor)
B&W Monitor)
RGB Monitor) for unit under test
Colour TV)

Model B + Disc

Either:	FIT Cassette + Disc Test Kit
or:	Model B + "A+B" Test Station Kit + Disc Test Kit + Monitor

Plus:

FIT PCB)
B&W Monitor)
RGB Monitor) for unit under test
Colour TV)
Dual 80 track Disc Drives)

Model B + Disc + Econet

Model B + Econet)
"A+B" Test Station Kit)
Econet Test Kit) for test station
Disc Test Kit)
FIT PCB)
Monitor)
B&W Monitor)
RGB Monitor) for unit under test
Colour TV)
Dual 80 track Disc Drives)

N.B. Speech is now tested in Issue 3 FIT cassettes and all test stations.

1.3 PET MANUAL

THE MANUAL LISTED IN THE CONTENTS SECTION IS NOW SUPPLIED WITH THE TEST EQUIPMENT ITSELF.

IF YOU REQUIRE A COPY FOR HISTORICAL PURPOSES, PLEASE REMOVE THIS PAGE, COMPLETE THE ADDRESS SECTION BELOW, AND FORWARD TO:

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Customer Service Department
Acorn Computers Ltd.
Cambridge Technopark
645, Newmarket Rd.
Cambridge.
CB5 8PD

We apologise for any inconvenience this may have caused.

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ACORN COMPUTERS LTD. ENGINEERING INFORMATION SHEET

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EQUIPMENT
BBC MICROCOMPUTER FIT TEST STATION KIT (Models A + B)

HEIGHT (mm)
N/A

WIDTH (mm)
N/A

FROM Alan Po
PROJECT LEADER

ORDER CODE
ABX 11

PART NUMBER
003,015

DEPTH (mm)
N/A

MATERIAL
N/A

TO:
CUSTOMER SERVICES
SALES
ACCOUNTS
R & D MANAGER
CHIEF ENGINEER
PRODUCT SERVICES
GROUP LEADER

FUNCTION
To provide necessary hardware and software and operating instructions to convert a Model B computer to be a FIT Test Station for Models A + B.
N.B. Also includes software (only) for Econet Tests.

COLOUR
N/A

CONSTRUCTION
N/A

OPERATES WITH (Peripherals)
FIT Test PCB (ABX 02)
Model B computer (ANB 01)
Monitor

CONTROLS (Switches, pots., keyboards)
None

SIMILAR EQUIPMENT
FIT Test PCB (ABX 02)
FIT Econet Test Kit (ABX 12)
Disc Test Kit (ABX 13)

INDICATORS (Meters, lamps, readouts, audible)
None

MAJOR COMPONENTS
Test Operating System EPROM (TOS)
Test Software EPROMs (FITR1 + FITR2)
Upgrade Instructions
Operating Instructions

Components for modifying FIT PCB

SIGNAL CONNECTIONS (V,A,Z, Baudrates, frequencies, connector type)
Cassette Leads: 7 pin DIN "Free" plugs both ends: wired 1:1 (standard cassette specs.)

DESCRIPTION OF OPERATION The FIT PCB modifications allow the test station to transmit the programs (from EPROMs FITR1 + FITR2), via the cassette socket and the FIT PCB, to the unit under test. These test programs are the normal FIESTA and FIESTB, as supplied on cassette. The unit under test transmits the Pass/Fail messages back to the test station. The test operating system is a slightly modified version of the normal operating system to improve the efficiency of the tests. FITR1 and FITR2 also include the software for testing disc and Econet interfaces (see 003,016/E and 003,017/E)

POWER IN (V,A,W,Hz,Connector type)
None

POWER OUT (V,A,W,Hz, Connector Type)
None

APPROVALS (BS,FCC,CSA, UL,VDE,BEAB)
None

GUARANTEE
6 months

OPERATING TEMPERATURE (°C)
0-35°c

WEIGHT (KG) UNIT ONLY 0.2

WEIGHT (KG) INC. PACKAGING & ACCESSORIES
0.25

CAPACITY
N/A

FORMAT
N/A

PACKAGING
Foam pad
Plastic bag
Cardboard stiffener
Jiffy bag

ACCESSORIES INCLUDED
2 x 7 pin cassette leads

SPEED (operating frequency)
1200 Baud

INSTALLATION
Dealer

APPENDICES
None

DRAWING NUMBER
003,015/E

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1.5 FIT MANUAL

THE MANUAL LISTED IN THE CONTENTS SECTION IS NOW SUPPLIED WITH THE TEST EQUIPMENT ITSELF.

IF YOU REQUIRE A COPY FOR HISTORICAL PURPOSES, PLEASE REMOVE THIS PAGE, COMPLETE THE ADDRESS SECTION BELOW, AND FORWARD TO:

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Customer Service Department
Acorn Computers Ltd.
Cambridge Technopark
645, Newmarket Rd.
Cambridge.
CB5 8PD

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ACORN COMPUTERS LTD. ENGINEERING INFORMATION SHEET

EQUIPMENT
FIT ECONET TEST KIT

HEIGHT (mm)
Test Box 65

WIDTH (mm)
Test Box 180

FROM: PROJECT LEADER

ORDER CODE
ABX 12

PART NUMBER
003,016

DEPTH (mm)
Test Box 120

MATERIAL
Plastic/metal panels

TO:
CUSTOMER SERVICES
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FUNCTION To provide the necessary hardware (except for the Econet Interface) to expand a Model A + B Test station to also test Models A + E and B + E. For model B + D + E the Disc Test Kit (ABX 13) is also required. Econet upgrade instructions also supplied.

COLOUR
Two-tone grey with brushed aluminium front and back panels

CONSTRUCTION
Moulded

OPERATES WITH (Peripherals)
Fit Test PCB (ABX 02)
Model B + Econet Computer (ANB 02)
Fit Test Station Kit (ABX 11)
Monitor (colour or B/W) or TV

CONTROLS (Switches, pots., keyboards)
None

SIMILAR EQUIPMENT
Fit test PCB (ABX 02)
Fit Test Station Kit (Models A + B) (ABX 11)
Disc Test Kit (ABX 13)

INDICATORS (Meters, lamps, readouts, audible)
None

MAJOR COMPONENTS
Box containing PCB with Econet Clock, two terminators, "Bad Line" network and switching relay.

SIGNAL CONNECTIONS (V,A,Z, Baudrates, frequencies, connector type)
2 off Econet (5 pin 180° DIN) connectors (Standard Econet Interface) on box.
2 off Econet (5 pin 180° DIN "Free") connectors per cable (Standard Econet Interface)
20-way ribbon cable wired 1:1 with IDC connectors with strain relief. TTL Levels.
20-way L/E header for ribbon cable IDC on box (TTL Levels)

DESCRIPTION OF OPERATION
The Econet test box allows interconnection of the test station to the computer under test. Once an initial cassette interface test is completed, all transfer of programs and data between the two machines is via the Econet link. The test routine is the standard Model A or B FIT test preceeded by a sequence of Econet tests on both "good" and "bad" lines.

POWER IN (V,A,W,Hz,Connector type)
5 volts DC via connector on front of BBC PSU to test box

POWER OUT (V,A,W,Hz, Connector Type)
None

APPROVALS (BS,FCC,CSA, UL,VDE,BEAB)
None

GUARANTEE
6 months

OPERATING TEMPERATURE (°C)
0-35°c

WEIGHT (KG) UNIT ONLY 0.5

WEIGHT (KG) INC. PACKAGING & ACCESSORIES 0.55

CAPACITY
N/A

FORMAT
N/A

PACKAGING
Two-part polystyrene
Cardboard box

ACCESSORIES INCLUDED
2 x Econet Cables
1 x 20-way Ribbon Cable
1 set ECONET upgrade instructions

SPEED (operating frequency)
Econet clock @ 370k

INSTALLATION
User

APPENDICES
None

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EQUIPMENT
BBC MICROCOMPUTER ECONET UPGRADE KIT

HEIGHT (mm)
N/A

WIDTH (mm)
N/A

FROM: Geoffrey Vincent
PROJECT LEADER

ORDER CODE
ANB 12

PART NUMBER
003,960

DEPTH (mm)
N/A

MATERIAL
N/A

TO:
CUSTOMER SERVICES
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ACCOUNTS
R & D MANAGER
CHIEF ENGINEER
PRODUCT SERVICES
GROUP LEADER

FUNCTION
Allows any BBC Microcomputer to be upgraded to include an Econet Interface.

COLOUR
N/A

CONSTRUCTION
N/A

OPERATES WITH (Peripherals)
Econet Network (cabling, clock box and two terminator boxes)

CONTROLS (Switches, pots., keyboards)
None

SIMILAR EQUIPMENT

Models:	A + E	(ANA 02)
	B + E	(ANB 02)
	B + D + E	(ANB 04)

INDICATORS (Meters, lamps, readouts, audible)
None

MAJOR COMPONENTS
NFS EPROM (2764)
68B54 ADLC

All Other Necessary ICs and Discrete Components
5 pin 180° DIN Socket (PCB Mount)

SIGNAL CONNECTIONS (V,A,Z, Baudrates, frequencies, connector type)
5 pin 180° DIN Socket (PCB Mounting).
Standard Econet Specifications.

DESCRIPTION OF OPERATION
Data can be transmitted along the network between machines, which also allows sharing of resources such as disc drives and printers.

POWER IN (V,A,W,Hz,Connector type)
None

POWER OUT (V,A,W,Hz, Connector Type)
None

APPROVALS (BS,FCC,CSA, UL,VDE,BEAB)
None

GUARANTEE
6 months

OPERATING TEMPERATURE (℃)
0-35°c

WEIGHT (KG) UNIT ONLY 0.2

WEIGHT (KG) INC. PACKAGING & ACCESSORIES
0.25

CAPACITY
Dependent on model of computer and other facilities on the Econet

FORMAT
N/A

PACKAGING
Polystyrene and clingfilm
Jiffy Bag

ACCESSORIES INCLUDED
Econet User Guide
1m Econet Lead

SPEED (operating frequency)
Network clock rate 76 to 370k

INSTALLATION
Dealer

APPENDICES
None

DRAWING NUMBER
003,960/E

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EQUIPMENT
DISC TEST KIT

HEIGHT (mm)
N/A

WIDTH (mm)
N/A

FROM: Alan PROJECT LEADER

ORDER CODE
ABX 13

PART NUMBER
003,017

DEPTH (mm)
N/A

MATERIAL
N/A

TO:
CUSTOMER SERVICES
SALES
ACCOUNTS
R & D MANAGER
CHIEF ENGINEER
PRODUCT SERVICES
GROUP LEADER

FUNCTION
To provide the ability to test the BBC Microcomputer disc interface with or without a FIT test station.

COLOUR
N/A

CONSTRUCTION
N/A

OPERATES WITH (Peripherals)

BBC 80 track disc drives (AND 02)
Monitor

CONTROLS (Switches, pots., keyboards)
None

SIMILAR EQUIPMENT
FIT Test Station Kit (ABX 11)
FIT Econet Test Kit (ABX 12)
FIT Test PCB (ABX 02)

INDICATORS (Meters, lamps, readouts, audible)
None

MAJOR COMPONENTS

```
3 Discs:  Test 0      )
          Scratch 0 )  All 80 track
          Scratch 1 )
```

Instruction Manual

SIGNAL CONNECTIONS (V,A,Z, Baudrates, frequencies, connector type)
None

DESCRIPTION OF OPERATION

The "Test 0" disc contains 3 programs:
1) DITEST: For use without test stations. This tests drive select, write protect, sector save/read and a comparison of the save/read data.
2&3) FTESTD2&3: The model B FIT Test station program incorporating DITEST.

The "Scratch 0" and "Scratch 1" discs are formatted and specially titled discs containing no programs.

POWER IN (V,A,W,Hz,Connector type)
None

POWER OUT (V,A,W,Hz, Connector Type)
None

APPROVALS (BS,FCC,CSA, UL,VDE,BEAB)
None

GUARANTEE
6 months

OPERATING TEMPERATURE (°C)
0-35°c

WEIGHT (KG) UNIT ONLY 0.25

WEIGHT (KG) INC. PACKAGING & ACCESSORIES 0.30

CAPACITY
N/A

FORMAT
BBC 80 Track

PACKAGING
Cardboard Stiffener
Jiffy Bag

ACCESSORIES INCLUDED
None

SPEED (operating frequency)
N/A

INSTALLATION
User

APPENDICES
None

DRAWING NUMBER
003,017/E

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FORM ISSUE 1 10.2.83

1.9 ELECTRON PRODUCTION INSPECTION TESTER (P.I.T.)

The Electron PIT is intended for use both as part of the production test procedure and also as a diagnostic for after sale maintenance and servicing.

To carry out the PIT test procedures the following equipment is required:

1. One Electron computer to be the Unit Under Test (UUT).
2. One Electron P.I.T., complete with 50 way ribbon cable assembly, two 7 pin cassette leads and the latest P.I.T. test software.
3. One BBC Microcomputer Model B (ANB01) with the latest issue BBC Electron Test ROM (B.E.R.T.) fitted inposition I.C.88.
4. One colour TV, one RGB monitor and one monochrome video monitor, each with connecting leads to the Electron.
5. One Electron mains adaptor.

The tests consist of a selection of visual, audible and internal checks. The internal checks will only provide FAIL messages, if they are OK then the operator will not be aware of their having happened, as they occur whilst the audio/visual tests are running. If any FAIL messages appear on the screen the operator must note the message and then press the space bar to continue. Unless the failure is of a catastrophic nature, the test must be run to its conclusion in order to provide all the diagnostic information possible.

The tests that are carried out are as follows:

1. The tests begin with Mode 6 which consists of a visual test and also a sound test of 5 consecutive notes. After the sequence of notes and graphics has been completed the test move automatically onto the next stage.
2. The second stage is a Mode 5 test which follows the same principles as the previous stage. Since this is a graphics mode the range of colours and symbols is more varied but the sound test remains the same.
3. The third stage of the test sequence is a RAM test. The only indication of this is that the screens will go black for about four seconds. This test will only give a message if it FAILS.
4. The next test is for Mode 4 and the test is exactly the same as the Mode 6 test.
5. After the Mode 4 test the cassette motor relay is checked.
6. At this stage the remaining Modes are tested:
   The Mode 3 test : as the Mode 6 test
   The Mode 2 test : as the Mode 5 test
   The Mode 1 test : as the Mode 5 test
   The Mode 0 test : as the Mode 4 test
7. Stage 6 completes the Graphics and sound tests and stage 7 moves on to test the keyboard.

8 After the keyboard test is complete the P.I.T. tests the reset function followed by the NMI's.

This completes the tests carried out by the P.I.T., complete instructions for configuring and running the P.I.T. test are found in the manual accompanying the package.

ELECTRON WATCHDOG

The Electron Watchdog is designed as a first line functional test which enables an Electron to be soak tested without constant supervision. The computer to be tested is plugged into the Watchdog by means of a 50-way edge card connector with the power OFF. The unit is then switched on and left for the specified soak test time.

The Watchdog will indicate by means of red or green LEDs whether the machine has passed or failed the soak test. Limited diagnostic information is given in the event of a failure. A typical example would be if the green LED failed to light at the beginning of the test. This would be an indication that the machine must be returned for repair. Various combinations of red LEDs being lit during, or at the end of the test, may indicate probable sources of failures such as the ULA, the 6502, or an intermittent fault.

If the Electron fails the Watchdog soak test, and the cause of the failure is not immediately obvious, the unit under test should be subjected to the P.I.T. for a more complete diagnosis of the failure.